MARKET SURVEY OF COAL RESEARCH LABS MOBILE WATER TREATMENT/DEWATERING PLANTS AND AN ESTIMATE OF COST TO MAINTAIN AND UPGRADE THESE UNITS [Part of the Program of the Federal Panel on Energy R&D (PERD)]

Final Report

by

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PROJECT NO. 8331-15

Work on the project was conducted under
the auspices of the Canada Centre for Mineral
and Energy Technology, Energy, Mines and Resources Canada.

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CANMET SCIENTIFIC AUTHORITY: D. BROWN

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April 18, 1991

Project No. 8331-15

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P.O. Bag 1280
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Attention: Dr. T.D. Brown
Director

Dear Sirs:

Kilborn Engineering Pacific Ltd. is pleased to submit five (5) copies of our report for the marketing study entitled:

MARKET SURVEY OF COAL RESEARCH LABS MOBILE WATER TREATMENT/DEWATERING PLANTS AND AN ESTIMATE OF COST TO MAINTAIN AND UPGRADE THESE UNITS

The study presents the results from the industry survey, the conclusions and recommendations for the use of the water treatment/dewatering trailers.

We trust this report is acceptable for your current level of evaluation and will be pleased to answer any questions should they arise.

Yours very truly,

KILBORN ENGINEERING PACIFIC LTD.

G.B. Bosworth P.Eng.
Senior Coal Preparation Engineer

GBB/ljl

cc: KEPL Project File

MARKET SURVEY OF COAL RESEARCH LABS MOBILE WATER TREATMENT/DEWATERING PLANTS AND AN ESTIMATE OF COST TO MAINTAIN AND UPGRADE THESE UNITS [Part of the Program of the Federal Panel on Energy R&D (PERD)]

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1.0 EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

Kilborn Engineering Pacific Ltd. (Kilborn) has been retained by CRL/CANMET to conduct a marketing survey for the use of the existing water treatment/dewatering trailers on the coal industry and to industries outside of the coal industry and to estimate costs for maintaining or upgrading the trailers to the year 2000.

Kilborn prepared a fifteen question survey which was distributed to thirty four (34) companies in various industries. Chiefly, the coal, potash, oil sands, oil refining, pulp and paper, base metal and municipal industries were contacted as a preliminary investigation into CRL/CANMET expanding its uses for the mobile water treatment/dewatering trailers.

The survey responses are tabulated in Section 3.0 and the results serve as basis for the marketing plan. Kilborn initiated a format in which a preliminary telephone call is made to advise of the survey and then forwarded a facsimile questionnaire. A subsequent telephone call was made to the companies who did not respond. This method produced a success rate of 60 percent even though all the companies agreed to complete the survey.

The conclusions from the survey indicate clearly, for the moment, that the coal operators have limited use for the trailers. Two of the three oil sands companies and two of the five companies in the oil refinery section (heavy oil producing companies) surveyed expressed interest in the trailers. The survey responses also revealed that there is

no interest in using the trailers in the potash, pulp and paper, base metal and municipal industries.

From the above it is clear that future work for the trailers is limited to distinct industries. Therefore a concise business plan, say ten (10) years, must be developed by CRL/CANMET if future work is to be secured. By concentrating on the new industries, this can also provide an opportunity to further promote CRL/CANMET services within the coal industry.

No further capital expenditures are required for the trailers over the next ten (10) years, as the trailers are equipped with a broad range of dewatering equipment. Currently there is no new mechanical dewatering equipment being used by industry and there does not appear to be any new technology being pursued.

Kilborn does not foresee any increase in operating costs for the trailers over the next ten years. A nominal costs of $120,000 per annum is based on the maintenance of the trailers for two projects per year.

1.0 SOMMAIRE EXECUTIF

1.0 SOMMAIRE EXECUTIF

Kilborn Engineering Pacific Ltd. (Kilborn) a été retenu par CRL/CANMET pour explorer le marché dans le but de trouver de l'emploi pour l'equipement de traitement d'eau et de séchage mécanique, equipement actuellement assemblé sur des remorques mobiles. L'industrie charbonnière et toutes les autres industries ont été considérées.

De plus, CRL/CANMET a demandé à Kilborn de faire des estimations pour l'entretien et l'amélioration de l'équipement jusqu'à l'an 2000.

Kilborn a préparé un document d'enquête contenant quinze questions qui a été distribué à trente quatre sociétés différentes ayant leurs principales activités dans les domaines du charbon, de la potasse, des gisements pétrolifères, des raffineries pétrolières, des industries de la pulpe et du papier, des métaux de base et des municipalités.

Les réponses à l'enquête ont été tabulées en Section 3.0 et les résultats font la base de la stratégie du marché.
Le format d'action de Kilborn consistait d'abord à aviser chaque société sélectionnée par téléphone de l'intention d'envoyer le questionnaire d'enquête puis d'envoyer une télécopie du document en question. Chaque société ainsi contactée était d'accord pour compléter le questionnaire.

Les sociétés qui n'avaient pas répondu furent contactées par téléphone. Il est à noter que ce format d'action a produit un taux de succès de 60 pourcent.

Les conclusions de l'enquête indiquent d'une façon décisive qu'il n'y a actuellement pas beaucoup d'intérêt chez les opérateurs de l'industrie charbonnière. Deux compagnies pétrolières parmi les cinq grosses industries productrices de pétrole ainsi que deux compagnies, parmi les trois companies de gisements pétrolifères, ont démontré un intérêt dans les remorques. L'enquête a laissé voir que les autres industries contactées n'étaient pas intéressées.

L'emploi des remorques mobiles est donc limité à des industries distinctes. Ainsi, si CRL/CANMET veut préserver du travail futur, elle devra développer un plan d'action commercial concis qui pourrait couvrir les dix prochaines années tout en se concentrant sur les industries nouvelles. Ce plan pourrait entraîner des possibilités pour les services de CRL/CANMET dans le secteur de l'industrie charbonnière.

Étant donné que les remorques mobiles sont équipées de tout l'équipement nécessaire et normalement employé dans l'industrie pour effectuer le séchage mécanique des produits, il n'y a pas lieu de considérer une dépense additionelle en capital d'ici dix ans. Actuellement l'industrie n'emploi pas d'autre équipement de séchage mécanique et il est apparent que les nouvelles technologies ne sont pas poursuivies.

Kilborn ne prévoit pas une augmentation du coût d'entretien d'ici dix ans, le coût nominal annuel de $ 120 000 étant basé sur l'entretien normal supposant l'exécution de deux projects par année.

2.0 INTRODUCTION

2.0 INTRODUCTION

Coal Research Laboratories (CRL)/CANMET requires a marketing strategy for its three mobile water treatment/dewatering units at the Coal Research Centre in Devon, Alberta.

Kilborn Engineering Pacific Ltd. (Kilborn) has been retained by CRL/CANMET to conduct a marketing survey on the coal industry and to industries outside of the coal industry and to estimate costs for maintaining or upgrading the trailers to the year 2000.

A kick-off meeting was held with Mr. A. Romaniuk, Manager, Office of Business Development for CRL/CANMET. It was agreed to concentrate the market survey on industries within a reasonable travelling distance from Devon, Alberta, i.e. Western Canada.

Kilborn developed and issued a questionaire to companies in the coal, oil sands, oil refining, potash, base metal, pulp and paper and municipal industries. A total of thirty-four (34) questionnaires were issued with follow-up telephone calls. The surveys were completed by 60% of the companies.

The responses were tabulated and analyzed and thus became the framework of the marketing approach for the trailers.

A review of the capital and operating costs are noted in Section 5.0.

2.1 SCOPE OF WORK

Background

The Coal Research Laboratories/CANMET needs to define a marketing strategy for its three mobile water treatment/dewatering units at the Coal Research Centre in Devon, Alberta and for assets management purposes, needs an estimate of the cost, over the next 10 years, of maintaining and upgrading these mobile plants.

The plants are described in a CANMET fact sheet, copy attached.

The successful contractor will have been directly involved in the design or construction of coal processing plants in western Canada, and will demonstrate familiarity with:

- coal tailings and effluent treatment technologies;
- current issues facing various industries concerned with the treatment and storage of effluents;
- innovative waste treatment and dewatering technologies;
- market survey methodology and reporting.

Work Statement

Define a marketing strategy for CRL/CANMET's three mobile water treatment/dewatering units for clients inside and outside the coal industry in Canada. This part of the report will identify specific technological opportunities for

appropriate client groups, including opportunities to collaborate with the consulting engineering profession in generating data needed in their feasibility studies. A strategy for realizing these opportunities with specific client groups needs to be outlined. The report will include an assessment of the competitive position of CRL/CANMET's mobile plants.

For each of the three units comprising the mobile plants, estimate costs for the decade ending in the year 2000 for (a) maintaining, and (b) upgrading these facilities, including specification of new technologies likely to need mine site support. This part of the report will be in a format suitable for assets management purposes.

No doubt the most effective approach in assessing any client's interest in using CRL's expertise and equipment is in face-to-face discussions at his work site. The numbers and locations of potential clients make this approach impractical in this study, perhaps with a few exceptions. Other approaches will be necessary. To get busy process plant managers to respond requires good working relationships, at the corporate and especially the individual level. Hence, in evaluating contractors, much importance has been assigned to the relevant experience of the principal investigator(s).

Deliverables

- a draft report shall be submitted to the Scientific Authority;

- an oral presentation highlighting the draft report shall be made at Devon Coal Research Centre to CRL/CANMET management;

- the final report, in five copies, shall include a French language version of the summary.

Energy, Mines and Resources Canada
Energie, Mines et Ressources Canada

FACT SHEET

CANMET

Canada Centre for Mineral and Energy Technology
Centre canadien de la technologie des minéraux et de l'énergie

MOBILE WATER TREATMENT AND DEWATERING PLANTS

The mobile plants are a facility designed for on-site-testing at any location where coal preparation plants are operated. Their main objective is to use state-of-the-art technology to evaluate effluent water treatment and dewatering of tailings or cleaned coal. This f cility, comprised of three trailers which can be used separately or in various combinations, is used to evaluate production circuits for water treatment or dewatering and demonstrate equipment or procedures to improve performance. The trailers are also ideal for workshops at which specific technologies can be explained theoretically and practically.

Equipment is mounted on heavy-duty highway trailers 15.2 meters long, 2.6 m wide and 4.1 meters high, suitable for road or rail transportation. Staffing usually involves both CRL and operating company personnel, as negotiated.

Mobile Water Treatment Plant

This trailer contains a conventional thickener, classifier cyclone, solid bowl centrifuge, flocculant preparation system and a choice of several methods of mixing slurry with flocculent. The mobile plant is capable of treating up to 40 m^3/h of effluent water. Field trials at a number of western Canadian coal preparation plants have resulted in a reduction of effluent pumped to tailings ponds and impr ved flocculant use.

Mobile Dewatering Plant

This plant consists of two units matched in capacity (2 to 3 tph) that provide alternate technologies to dewater tailings or clean coal product. The modules can be used in conjunction with the mobile water treatment plant.

Dewatering Unit No. 1: contains a recessed plate pressure filter, disc filter and filter-aid preparation and mixing equipment. The pressure filter is equipped with a hydraulic system for opening and closing the plates, and is designed to allow operation up to 1550 kPa working pressure. The disc filter is a 1.2 m diameter 2-disc unit equipped with controlle le vacuum at both forming and drying stages and allows collection of filtrate samples at each stage. Field testing at a wash plant demonstrated that with the disc filter, the usual 20% cake moisture content could be reduced to less than 14%.

Dewatering Unit No. 2: contains a belt filter press, a screen bowl centrifuge and filter-aid preparation and addition equipment. The belt filter press is operated with a hydraulic system to adjust and control the belt tension, alignment and tracking. The centrifuge is equipped with a variable speed and back-drive and has digital readouts. The mixing of feed and filter-aid can be done by two methods: in-line and by in-line static mixer. Field testing has generated optimizing curves for retention time (belt speed) and flocculent dosage, and predicted cake thickness, cake moisture and solids recovery.

Energy, Mines and Resources Canada | Énergie, Mines et Ressources Canada

CANMET

Canada Centre for Mineral and Energy Technology | Centre canadien de la technologie des minéraux et de l'énergie

COAL RESEARCH LABORATORIES

The Coal Research Laboratories (CRL) perform and sponsor research to enhance Canadian industry's competitive position. With laboratories in Devon, Alberta and Sydney, Nova Scotia, CRL is well located to serve both coal and other industry clients, notably those in the mining and processing of oil sands.

Staff perform mission-oriented research and development primarily in mining and process chemistry. Cost-sharing and task-sharing of research with with Canadian industry clients is the preferred modus operendi. Advisory councils, comprised mostly of experts from industry, annually review CRL's activities and recommend research priorities.

COAL

Coal is one of Canada's most valuable mineral commodities. Coal also has strategic significance as this fossil fuel represents a cap on the long-term price of oil and gas.

CRL's coal mining and preparation research aims at increasing the productivity of Canadian mining operations, and improving the quality and diversity of the nation's saleable coal products.

In surface mining research the focus is on operations research, advanced technology, geotechnical engineering and spontaneous combustion. Underground mining research, centred at the Cape Breton Coal Research Laboratory, is focused on improving occupational health and safety, and mine productivity.

Coal preparation research at CRL is directed toward improving the removal of contaminants, in-increasing the recovery of coal fines in western mountain coals, reducing the transportation costs and reducing pollution.

OIL SANDS

Oil sands and coal share significant technological problems in mining and processing. CRL's expertise and the proximity of laboratories at Devon, Alberta have resulted in collaboration with operators in both the Fort McMurray and Cold Lake regions. CRL's expertise in surface chemistry is being applied to process treatment of bitumen/oil emulsions, problems associated with the effluent waters, and tailings.

Facilities and Capabilities

CRL is comprised of three laboratories:

- Surface Mining Laboratory;
- Fuel Processing Laboratory and,
- Underground Mining Laboratory.

The Surface Mining Laboratory and the Fuel Processing Laboratory are both housed in the new Coal Research Centre at Devon, Alberta. From this central location, access to the plains coals of Saskatchewan and Alberta, to the oil sands of Alberta, as well as to the coal mines in the mountains of Alberta and British Columbia, is rapid and inexpensive. The Underground Mining Laboratory at Sydney, Nova Scotia, is situate within 10 miles of Canada's three major underground coal mines.

TECHNOLOGY TRANSFER

Utilization by Canadian industry is the goal of CRL's research effort.

CRL's clients include coal operators, oil sands companies, oil and gas companies, utilities, consulting companies, private laboratories, provincial organizations, and national and international agencies. Services to these clients range from evaluating world-wide technologies to addressing specific needs of individual companies. Various other federal programs exist to give Canadian companies access to CRL's advanced facilities and expertise

Contact

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The Coal Research Laboratories (CRL) are a division of the Canada Centre for Mineral and Energy Technology (CANMET). CANMET, the major technological arm of Energy, Mines and Resources Canada, has facilities in Ottawa, Sudbury, Elliot Lake, Edmonton (Devon) and Sydney.

Canada

Coal Research Laboratories / Laboratoires de recherche sur le charbon

3.0 MARKETING SURVEY QUESTIONNAIRE RESPONSES

3.0 MARKETING SURVEY QUESTIONNAIRE RESPONSES

CRL/CANMET requested Kilborn to provide a marketing survey for the mobile water treatment/dewatering trailers. The basis of the questionnaire is provided as follows.

This survey represents a preliminary investigation to see if CRL/CANMET can further apply their skills in the coal industry and to expand into non-coal industries.

The questionnaire was designed to extract the following information:

- Current mechanical dewatering practices for product and refuse.
- Are moisture specifications being obtained.
- Ascertain if mechanical dewatering test facilities would be applicable.
- Determine how companies conduct dewatering test programs and what is the expected length of a test program.
- Determine if environmental work is present.
- Determine if the trailer can be used for training purposes.

The survey was first initiated by a telephone conversation to the respective plant superintendent or manager. Kilborn felt that contact via telephone prior to sending the facsimile would result in a higher success rate for return of the questionnaire. A subsequent telephone call to the companies who did not respond to the facsimile was made after 14 days. This method produced a 60 percent success rate even though all the companies agreed to complete the survey. A copy of the questionnaire is presented in Appendix A.

The following table summarizes the responses for each industry contacted. As stated in the introduction section of the questionnaire, all responses would be treated in the strictest confidence. Therefore, Kilborn has chosen to identify the companies by an alpha description.

3.1 **COAL INDUSTRY**

	CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E	Company F
1.	What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	Mech. dewater. +0.6 mm; 0.6 x 0 mm vacuum filter followed by thermal drying	Closed water system +100 mesh centrifuge mech. 100 x 0 vacuum filter followed by thermal drying	Mech. dewater. +100 mesh belt filter press - 100 mesh followed by thermal drying	Mechanical followed by thermal drying	Mechanical dewater followed by thermal drying	Mechanical dewater tailing thickener no thermal drying
2.	How do you dispose of your fine refuse product? Do you dewater the fine refuse?	Tailings pond no fines dewatering	Fine refuse 28 x 100 mesh centrifuge mech. dewatering, mixed with coarse refuse and trucked to refuse dump	Fine refuse is dewatered and mixed with coarse refuse for disposal	Belt filter press	- Tailings pond - Fines not dewatered	Tailings pond
3.	Are you meeting your moisture targets, if not, please describe the problem?	Yes	Yes	Yes	Yes	Yes	Yes
4.	Have you ever investigated using different types of mechanical dewatering equipment. If yes, please describe.	No	Dravo puck formation and froth flotation	N/A	Screw classifier	Thickening tailing with cyclones	No
5.	Would you require pilot plant testing before purchasing new equipment and if not how would you proceed in selecting your equipmnt?	No (No new equipment required)	Yes	N/A	No	Yes	Yes
6.	Would you consider using an on-site testing facility for dewatering and water treatment?	Only in case of a significant process modification.	Yes	See No. 15	No	Yes	Yes

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3.1 COAL INDUSTRY (cont'd.)

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E	Company F
7. If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	No	No	See No. 15	Yes	No, except for cycloning of tailings	No
8. Do you see your plant requiring any future testwork on dewatering?	Only in case of a significant process modification	Yes, but is not a priority at this time	Not in foreseeable future	Not now	Yes slurry 35% solid and 90% - 325 mesh	Some potential although current practice works well
9. If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	In-house	In-house	In-house	In-house	Lab scale benchwork in-house	In-house
10. What would be a reasonable testing period, one week, two weeks, one month or six months?	Two weeks if there is a need	One month	N/A	No reply	Depend on scope and available funds	No reply
11. Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	Technically possible required capacity of 90 m^3/h	Yes	N/A	No	No	No reply
12. Can your firm use these trailers for environmental testwork?	No	No	N/A	No	No	No
13. Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	No	No	No	No	No	No

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3.1 COAL INDUSTRY (cont'd.)

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E	Company F
14. Would you consider using these trailers for training purposes?	No	Yes	- Have done so in the past - If units are in the area use for educational reasons	Not at this time	No	No
15. Please write any other comments that you feel may be useful in assessing the future needs of CANMET's water treatment/ dewatering trailers?			Have used units before for: a) Confirmation of existing operation b) Evaluate flocculant types and application c) Used for educational purposes			

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3.1 COAL INDUSTRY (cont'd.)

CANMET Market Survey Questionnaire	Company G	Company H	Company I	Company J	Company K	Company L
	No reply received	No reply received	No reply received	No reply received	No reply received	No reply received

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3.2 OIL SANDS INDUSTRY AND OIL REFINERIES

3.2.1 Oil Sands Industry

CANMET Market Survey Questionnaire	Company A	Company B	Company C
1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	N/A	Tailings discharge into pond Coarse tails used for dykes and fine tails flow center	No reply
2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?	Tailings pond gravity sedimentation	No, want to dewater fine tails	
3. Are you meeting your moisture targets, if not, please describe the problem?	Vast volumes of sludge	Not a criteria	
4. Have you ever investigated using different types of mechanical dewatering equipment If yes, please describe?	Everything either too expensive or do not reduce the problem	Yes, Continuous centrifuge	
5. Would you require pilot plant testing before purchasing new equipment and if not how would proceed in selecting your equipment?	Yes	Yes	
6. Would you consider using an on-site testing facility for dewatering and water treatment?	Yes	Yes	No reply
7. If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	Yes	Yes, Dearborn for water treatment and purification	
8. Do you see your plant requiring any future testwork on dewatering?	Yes	Yes	

3.2.1 Oil Sands Industry

CANMET Market Survey Questionnaire	Company A	Company B	Company C
9. If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	No current work. But open to reasonable proposals	All three	No reply
10. What would be a reasonable testing period, one week, two weeks, one month or six months?	One to six months	All three	
11. Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	Yes	Two weeks One month	
12. Can your firm use these trailers for environmental testwork?	Possible	Yes, fine tails	
13. Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	Yes	Yes, fine tails	
14. Would you consider using these trailers for training purposes?	No	No	
15. Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/dewatering trailers?	No	No	

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3.2.2 Oil Refineries

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	Settling only. No thermal dewatering	Concentrate by heat applied in a steam coil	None	No reply	No reply
2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?	Roads	Sludge from ponds disposed at saw mills	Landfill		
3. Are you meeting your moisture targets, if not, please describe the problem?	No reply	Want to decrease volume of sludge			
4. Have you ever investigated using different types of mechanical dewatering equipment If yes, please describe?	Not lately, centrifuge 1985, partial success	No	Yes, examining options		
5. Would you require pilot plant testing before purchasing new equipment and if not how would proceed in selecting your equipment?	Possible	Sludge disposal about once every 10 years	Yes		

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3.2.2 Oil Refineries (cont'd)

	CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
6.	Would you consider using an on-site testing facility for dewatering and water treatment?	Yes	Yes	Yes	No reply	No reply
7.	If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	Yes, see item 4	No	Yes, de-oiling, departiculating & softening pilots		
8.	Do you see your plant requiring any future testwork on dewatering?	Not immediate	Possibly	Yes		
9.	If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	In-house	N/A	All of the above		
10.	What would be a reasonable testing period, one week, two weeks, one month or six months?	No reply	One week	6-12 months for reliability and maintenance determination		
11.	Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	No	Possible to dewater pond sludge for ultimate disposal	Possibility of pond water removal		
12.	Can your firm use these trailers for environmental testwork?	No	Possible	Potential exists		
13.	Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?		Yes	Yes		

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3.2.2 Oil Refineries (cont'd)

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
14. Would you consider using these trailers for training purposes?	No	Possible	Yes	No reply	No reply
15. Please write any other comments that you feel may be useful in assessing the future needs of CANMET's water treatment/dewatering trailers?	Needs are not immediate	Possible	Ongoing discussions with CANMET		

3.3 **POTASH INDUSTRY**

	CANMET Market Survey Questionnaire	Company A	Company B
1.	What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	Mechanical dewatering belt filter press and thermal dryers	Mechanical dewatering and thermal drying
2.	How do you dispose of your fine refuse product? Do you dewater the fine refuse?	Some are thickened and some are dewatered with belt filter press	Dewater by cycloning - recycle
3.	Are you meeting your moisture targets, if not, please describe the problem?	No reply	Yes
4.	Have you ever investigated using different types of mechanical dewatering equipment If yes, please describe?	Pusher centrifuge, basket centrifuge, belt filter press	Not since new design in place
5.	Would you require pilot plant testing before purchasing new equipment and if not how would proceed in selecting your equipment?	Would probably require pilot plant testing	Possible on slime handling
6.	Would you consider using an on-site testing facility for dewatering and water treatment?	Yes	Possibly need specific priority
7.	If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	Pilot testing of belt filter press	Yes - Over many years - Many times to gain experience
8.	Do you see your plant requiring any future testwork on dewatering?	Yes	No, with exception for slimes handling
9.	If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	Combination of in-house and manufacturer laboratories	Normally in-house and manufacturer laboratories
10.	What would be a reasonable testing period, one week, two weeks, one month or six months?	Two weeks	Depend on project, one month
11.	Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	Would use it for demonstrating the feasibility or the dewatering method	No

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3.3 **POTASH INDUSTRY (cont'd)**

	CANMET Market Survey Questionnaire	Company A	Company B
12.	Can your firm use these trailers for environmental testwork?	No reply	No
13.	Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	Not at this time	No
14.	Would you consider using these trailers for training purposes?	No	No
15.	Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/dewatering trailers?		Potash refining involves soluble salts in NaCl/KCL saturated brines. Desliming/ flocculation etc. differs from coal

KILBORN

3.4 BASE METAL INDUSTRY

CANMET Market Survey Questionnaire	Company A	Company B	Company C
1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	Thickening, filtration, thermal drying	Disc filter followed by gas fired rotary kiln dryers	Dewatering trommel slimes to tailings pond to thermal dewatering
2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?	N/A	N/A	Decant using trommel screen pump fines to tailings pond
3. Are you meeting your moisture targets, if not, please describe the problem?	Yes	Yes	No, filter fines and refuse to less than 10% moisture
4. Have you ever investigated using different types of mechanical dewatering equipment If yes, please describe?	Investigation only	Yes, diaphragm filter press	Yes, have used various types; tests by manufacturer
5. Would you require pilot plant testing before purchasing new equipment and if not how would proceed in selecting your equipment?	Yes	Yes	Yes, (already done)
6. Would you consider using an on-site testing facility for dewatering and water treatment?	Possible if the price was right	If necessity arose	Yes

KILBORN

3.4 **BASE METAL INDUSTRY (cont'd)**

	CANMET Market Survey Questionnaire	Company A	Company B	Company C
7.	If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	No	Mobile diaphragm filter press	No
8.	Do you see your plant requiring any future testwork on dewatering?	Possibly less than 50% chance	Not in foreseeable future	Yes
9.	If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	Likely in-house	N/A	Equipment manufacturer laboratories
10.	What would be a reasonable testing period, one week, two weeks, one month or six months?	One week	One week	One month or less
11.	Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	Dewatering	No	No

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3.4 **BASE METAL INDUSTRY (cont'd)**

CANMET Market Survey Questionnaire	Company A	Company B	Company C
12. Can your firm use these trailers for environmental testwork?	N/A	No	No
13. Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	N/A	No	No
14. Would you consider using these trailers for training purposes?	Possible	No	No
15. Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/ dewatering trailers?	Considers the plate and frame filter press a maintenance intensive piece of equipment not suitable for our operation	N/A	No comments

KILBORN

3.5 PULP AND PAPER INDUSTRY

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	N/A	None Gravity settling pond excavated to landfill every 5 to 6 months	No reply	No reply	No reply
2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?	Effluent is dewatered by a filter does not wish to change	Refuse goes to landfill			
3. Are you meeting your moisture targets, if not, please describe the problem?		No targets			
4. Have you ever investigated using different types of mechanical dewatering equipment If yes, please describe?		No			
5. Would you require pilot plant testing before purchasing new equipment and if not how would proceed in selecting your equipment?	For future work will investigate a screw press for dewatering	Depends on urgency. Numerous equipment available in the P&P industry			

KILBORN

3.5 PULP AND PAPER INDUSTRY (cont'd)

	CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
6.	Would you consider using an on-site testing facility for dewatering and water treatment?	No	Yes	No reply	No reply	No reply
7.	If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	No	Jar testing for effluent coagulation			
8.	Do you see your plant requiring any future testwork on dewatering?	No	Yes			
9.	If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	No	In-house			
10.	What would be a reasonable testing period, one week, two weeks, one month or six months?	No	One month			
11.	Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	No	A need in late 91 or 92 effluent decolorization and sludge disposal are main concerns			
12.	Can your firm use these trailers for environmental testwork?	No	Probably			
13.	Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	No	Yes			

KILBORN

3.5 PULP AND PAPER INDUSTRY (cont'd)

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D	Company E
14. Would you consider using these trailers for training purposes?		No	No reply	No reply	No reply
15. Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/ dewatering trailers?	Trailers are not applicable for future work	Screw presses are favoured dewatering devices and belt presses are common			

KILBORN

3.6 MUNICIPAL INDUSTRY

CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D
1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?	No current practice	N/A	Presently installing 2 Sharples solid bowl centrifuges. Digested sludge feed 2 - 2.5% solids; sludge cake 25 - 30% solids	No response received
2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?	N/A	Send sludge to farm land	N/A	
3. Are you meeting your moisture targets, if not, please describe the problem?	N/A	Have lagoons that may require some form of dewatering in the future	N/A	
4. Have you ever investigated using different types of mechanical dewatering equipment. If yes, please describe.	Only briefly	Filter press and centrifuge failed to meet our test criteria due to the cost per dry tonne	Rely on published reports and experience of other waste water treatment plants	
5. Would you require pilot plant testing before purchasing new equipment and if not how would you proceed in selecting your equipment?	Yes	Yes	Not usually. Select what works best at other plants	
6. Would you consider using an on-site testing facility for dewatering and water treatment?	Yes	Yes	May invite manufactures to demonstrate their equipment	
7. If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?	No	Yes	No	

3.6 **MUNICIPAL INDUSTRY (cont'd)**

	CANMET Market Survey Questionnaire	Company A	Company B	Company C	Company D
8.	Do you see your plant requiring any future testwork on dewatering?	Yes	Yes, within 3 to 5 years	Not at this time	No response received.
9.	If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?	N/A	Main criteria cost per dry tonne; work in-house	In-house laboratories	
10.	What would be a reasonable testing period, one week, two weeks, one month or six months?	One month	One week	3 - 6 weeks	
11.	Can your firm use a mobile testing facility for water treatment or dewatering? If so in what capacity?	Possible testing different feed and product waters	Yes	Not at this time	
12.	Can your firm use these trailers for environmental testwork?	Yes, only purpose	No	Not at this time	
13.	Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?	Yes, Atp effluent	Yes	N/A	
14.	Would you consider using these trailers for training purposes?	No	No	Not at this time	
15.	Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/dewatering trailers?	Please advise if there is a follow-up survey		Keep on file	

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4.0 DISCUSSION OF THE MARKETING SURVEY QUESTIONNAIRE

4.0 DISCUSSION OF THE MARKETING SURVEY QUESTIONNAIRE

A discussion of the marketing survey questionnaire is formalized in the following sections:

4.1 Coal Industry
4.2 Oil Sands Industry and Oil Refineries
4.3 Potash Industry
4.4 Base Metal Industry
4.5 Pulp and Paper Industry
4.6 Municipal Industry

4.1 COAL INDUSTRY

Six of the twelve operating coal mines responded to the questionnaire. A questionnaire was not issued to Fording Coal Ltd. because of CRL/CANMET's recent work.

The respondents claim that moisture specifications are being met and a majority of the operations have a thermal drying facility after the coal washing plant.

Only one of the coal companies has investigated alternative forms of mechanical dewatering and only three of the companies would make use of a pilot plant test facility. However, the majority of the coal companies would try on-site plant testing. Most preliminary testwork is done in-house.

The survey also found that there is little use for the trailers solely for training purposes.

Telephone conversations indicated that CRL/CANMET has been in contact with the operating mines and that the trailers have been used in the past at the coal plants.

All of the respondents claim that they do not require CRL/CANMET's services now.

Since the trailers are designed for the coal industry, CRL/CANMET should continue to pursue this industry. Based on low international coal prices, the current financial status of the Canadian coal companies and only one new coal plant being constructed, it is unlikely that any new business can be generated for a while. This is a good opportunity for CRL/CANMET to maintain existing relationships with the mines and can be simply done by visiting the operating mines a minimum of once per year and by subsequent phone call to see how the preparation plant is operating and if CRL/CANMET can be of any assistance.

4.1.1 Comments from Coal Companies

The following are general comments from the coal producers who have used the trailers in the past.

- The dewatering trailers need to be insulated and winterized for the cold weather months.

- All equipment and trailers must be operated prior to arriving on-site. This will ensure a smooth transition into the test program.

- More assistance by CRL/CANMET personnel in operating and training on the use of the trailers.

- It is difficult to make changes to the trailers to provide a smoother operation or modifications during testing.

- One coal company would request next time the trailers are used, a continuous sampling operation be employed. (Increased sample collection and operating on a continuous basis 24 hours per day).

- Of the firms who have used the trailers, many were hesitant at the beginning but were satisfied at the end of the project. Most companies would use the trailers again if a dewatering project became available.

4.1.2 Future Work

There appears little in the way of new dewatering equipment that the coal companies are using. Potential work may exist in agglomerates dewatering from the fine coal recovery process of oil agglomeration. CRL/CANMET trailers are designed for the dewatering testing, however the overall economics for the agglomeration process is a few years away.

A new coal preparation plant is under construction in Eastern Canada and CRL/CANMET should pursue this opportunity. Although the travelling time is quite far, CRL/CANMET should maintain contact with the operator.

If world coal prices increase, another area of future work is the reclamation of tailing ponds and CRL/CANMET would have to align themselves with a portable washing facility.

4.2 OIL SANDS INDUSTRY AND OIL REFINERIES

The most favourable response for the use of the dewatering and treatment trailers is with the oil sands industry and sludge dewatering at oil refineries.

At this time no major change or new dewatering devices are anticipated. A change in the feed preparation may be required.

4.2.1 Oil Sands Industry

The oil sands industry generated the most positive response to the market survey. It appears that fine tailings dewatering is a major problem. Many various dewatering tests have been conducted, however limited success has been obtained. CRL/CANMET trailers are well equipped with the necessary mechanical dewatering equipment and should definitely pursue this area.

4.2.2 Oil Refineries

The oil refineries generated a positive response to the questionnaire and one company is currently involved in discussions with CRL/CANMET. Potential projects exist for sludge dewatering (settlement ponds). One firm has expressed interest in having the settlement ponds dewatered once every 10 years. A large market exists for sludge dewatering in the Fort Saskatchewan area, Refinery Row in Edmonton and the Joffre area near Red Deer.

CRL/CANMET would have to ensure that they are not responsible for the solids and effluent disposal after treatment/

dewatering. At the end of this section is an article from Plant Engineering and Maintenance on dewatering sludge.

4.3 POTASH INDUSTRY

The responses received indicate a minimal requirement for the water treatment/dewatering trailers. This may be because the operators are not aware of the CRL/CANMET services. The potash industry is similar to the coal industry in that mechanical dewatering is followed by thermal drying. The major difference between the two industries is the corrosiveness of the brine solution. Piping and connections must be constructed of stainless steel.

With limited future work and the high capital cost associated with replacing existing piping with stainless steel piping, Kilborn recommends that no effort be applied to this industry.

A telephone call to the potash companies to explain CRL/CANMET's services is recommended and to confirm Kilborn's initial findings.

4.4 BASE METAL INDUSTRY

The process is very different from the coal washing process. The final product is the solids with the highest specific gravity (in contrast to the coal where this specific gravity fraction is the plant reject).

The mines that responded indicated that no problems exist with the tailings dewatering. The exception is the asbestos operation. This should be pursued as part of a business development plan.

No new equipment is expected to be required for testing of tailings dewatering.

4.5 PULP AND PAPER INDUSTRY

With new pollution standards imposed on the pulp and paper industries and regulations governing the discharge of suspended solids, oxygen depleting substances and actual toxic effluents, the present trailers are not designed to deal with this type of effluent. Existing dewatering equipment, with the exception of the belt press are not used in the industry. A dewatering device used in the pulp and paper industry is the screw press. Kilborn is not familiar with the screw press and its operating criteria. The capital cost of a screw press for the trailer is $275,000 (US). Information is presented in Appendix B regarding this dewatering unit.

Kilborn feels that this industry should not be discounted because of the number of new mills being constructed in Alberta and the new environmental regulations. Assistance to industry may be through the dewatering of the settling ponds where the refuse (sludge) is disposed to landfill. CRL/CANMET can incorporate a site visit to these mills when they are visiting coal operations or oil sands facilities to ascertain if a market exists. Other markets exist in British Columbia and Saskatchewan.

4.6 MUNICIPAL INDUSTRY

Potential exists with one firm that is indirectly connected with the municipal industry. This firm has requested a follow-up survey and contact by CRL/CANMET. The municipal

sewage treatment industry did not produce a favourable response since most sludge is disposed onto farmer's fields and does not require dewatering.

4.7 CONSULTING ENGINEERING COMPANIES

Telephone conversations with consulting engineering firms revealed that these firms are unaware of CRL/CANMET service and industries facilities. Three of the firms involved in the municipal industry have not heard of CRL/CANMET services. After describing CRL/CANMET services, the consulting engineering firm left the impression that they may recommend the use of CRL/CANMET but it would not be their first choice.

4.8 CRL/CANMET MARKETING STRATEGY

The survey responses indicate that the trailers are of little use in the coal industry at this particular time. Only the oil sands industry and sludge dewatering for oil refining produced a favourable result. The remaining industries have no requirements for the trailers.

Kilborn believes that work is available, however, a concentrated effort is required to secure future work. Even though the work is sporadic in the coal industry, CRL/CANMET must maintain a rapport with coal companies and develop new relationships in targeted industries, as in the case of the oil sands industry.

CRL/CANMET must prepare a yearly business development program. The program should include visits to the existing operations (coal and targeted industries) a minimum once per year.

CRL/CANMET must view this as business development and follow-up telephone calls are essential.

As commented by one of the coal companies, they are initially hesitant on what services CRL/CANMET can provide, but once CRL/CANMET is on-site and the program is completed they are very satisfied with the results. The trailers provide an opportunity for companies to confirm plant operating conditions and to predict what dewatering results may be expected under actual operating conditions. This is an unique facility for the coal and non-coal industries and CRL/CANMET must try to expand on the concept. By continuing the personal contact and follow-up telephone conversations this may improve the overall image of CRL/CANMET.

CRL/CANMET have chosen a broad range of mechanical dewatering equipment and thus there is no need to purchase additional equipment. The capital cost is similar to the existing equipment and the monies could be spent on business development.

One approach in securing future work is to utilize an individual who acts as a lead finder. This individual will make contact in various sectors and find business opportunities. It will then be up to the technical personnel to convince the client that they require CRL/CANMET services. This may not be practical for CRL/CANMET but should be investigated.

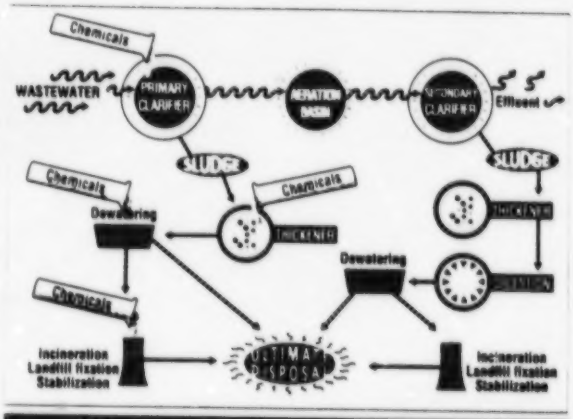
CRL/CANMET may wish to create a VHS video on the operation of the mobile trailers and issue the video to prospective clients. This will be very useful in explaining the benefits and various options for the trailers. The cost of a 10 minute video ranges from $25,000 to $50,000. CRL/CANMET may wish to improve their brochures.

The first order of business is to do a follow-up survey and contact with the coal, oil sands and oil refining companies to further establish CRL/CANMET's interest in the industries.

Pollution control By Lanny Barr

Dewatering your sludge can reduce your disposal costs

INDUSTRIAL WATER treatment produces two components: water and sludge. Three decades ago, water was treated, while sludge was sent straight to the landfill. That was before companies recognized both the environmental hazards of this simplistic approach and the economic benefits of reclaiming certain elements from their waste streams. The key to accessing the reusable matter locked in sludge is to dewater it. This produces dry cake that can be channeled into other products, and water that can be treated to produce cleaner effluent.



Wastewater treatment facility

The main elements of today's sludge/slurry treatment are: testing, conditioning, volume reduction, and disposal. A typical waste water treatment facility is outlined in the figure.

Sludge varies in concentration from one percent to 15 percent on a dry weight basis. Its specific gravity is in the 1.0 to 1.2 range, not much higher than water. Some slurries, with high organic content, have good fuel value. Others can be processed into building materials, pet food, fertilizers, or used in the recovery of metals. Special attention is needed when the slurry contains hazardous components.

Not all the water contained in a sludge is equally retained. There is free water, which is not attached to the solid particles, and bound water, which is linked to particles and biological cells. A typical waste activated sludge (water is fed into an aerated tank where micro-organisms metabolize and flocculate the organic particles) contains about 75 percent water, 20 percent floc water, two percent capillary water, two percent bound water, and one percent solids.

Before a treatment process can be decided upon, the behaviour of a sludge should be tested on a bench-scale. These tests evaluate dewaterability, fixation, stabilization, and solidification. The Buchner Funnel test measures the specific resistance of the sludge to filtration. Other assessment techniques are the Bariod test, filter press, and belt filter press.

Many types of sludge are difficult to dewater. The incorporation of certain additives (filter aids), or the precoating of the filtration membrane improves the process. This treatment is called sludge conditioning.

A filter aid adds body to the sludge and increases permeability during cake formation. Coal dust, fly ash, clay, perlite, diatomite, peat, talc, cellulose fibre, furnace slag, and activated carbon are all filter aids.

Volume reduction is achieved by dewatering the sludge. A drier cake means less water for disposal, and lower hauling costs. This is accomplished in drying beds, lagoons, centrifuges, rotary drum vacuum filters, belt filter presses, and plate and frame filter presses.

Drying beds and lagoons are the simplest and oldest method of dewatering sludge. The beds are ponds with a sand bottom. They can handle up to a foot of sludge, and, depending on the climate, form a cake in up to two months. They are simple, but use excessive amounts of land and labour. A technological advancement is the utilization of vacuum as a driving force for the water. The cake contains ten to twenty percent solids.

A centrifuge filter turns at high speed to force the filtrate out of the sludge. The process continuously removes a cake with a solid concentration of ten to thirty percent.

The rotary drum vacuum filter is commonly used for sludge dewatering. It features a large rotating drum covered with a permeable fabric that is partially immersed in the sludge. Vacuum from the inside of the drum pulls the water out of the sludge, while a cake builds up on the outside of the drum. A doctor blade scrapes the cake off. This type of filter allows good control over the process, which permits dewatering of sludge that varies in consistency.

The belt type filter has a vacuum drum. The filter medium is an endless belt which travels from the drum where the cake is formed, to the small diameter discharge roller where the cake breaks away (a blade is not required) and is removed.

The horizontal belt filter press features an endless belt which supports a filter fabric. The filter media is relatively coarse, promoting fast cake formation. It travels across a suction box where the liquid drains. The sludge is then squeezed between two belts, and further pressed through alternating rollers.

The filter press is widely used. Two types are available: plate and frame (flush type) and recess. The recess press features a number of vertical elements clamped together under pressure. In the plate and frame press, solid grooved plates alternate with hollow frames. The grooves support the filter media and let the filtrate discharge. The frames fill up with cake.

5.0 CAPITAL COSTS AND OPERATING COSTS

5.0 CAPITAL COSTS AND OPERATING COSTS

5.1 CAPITAL COST

It is Kilborn's opinion that the trailers incorporate a wide range of mechanical dewatering equipment that cover a variety of industries. The survey results indicated that no new dewatering equipment is being used in the coal industry and that similar equipment is used in other industries.

The pulp and paper industry use a screw press filter for solids dewatering but estimated budgetary pricing for a trailer mounted pilot unit is $275,000 (US) excluding installation and the demand is not present.

Therefore no new equipment is required for the existing trailers and the current equipment has operated so few hours it can be expected to last until the year 2000.

Attached at the end of the section is the original capital cost of the dewatering equipment as provided to Kilborn by CRL/CANMET.

5.2 OPERATING COSTS

Kilborn's discussions with CRL/CANMET personnel have indicated that operating costs are very low for the trailers. The monies are spent prior to the trailers going out on a project. Costs provided by CRL/CANMET indicate the maintenance costs for the water treatment trailer, dewatering trailer #2 and dewatering trailer #3 are $15,000, $20,000 and $25,000 per project. CRL/CANMET averages two projects per year and therefore the annual maintenance costs is $120,000. This cost

is high since CRL/CANMET uses equipment suppliers for equipment servicing. Miscellaneous costs for flocculant and operating supplies are paid by CRL/CANMET. To assist during winter test programs CRL/CANMET may wish to purchase plywood skirting and portable electric heaters for each trailer. The approximate cost is $3500 per trailer.

Since the current equipment has operated so few hours, it can be expected to last until the year 2000 with routine maintenance prior to the start of a new project.

Date: January 24, 1991

To: G.B.Bosvorth
Senior Coal Preparation Engineer
Kilborn Engineering Pacific Ltd
Vancouver, B.C.
V6J 2B7

From: Khalid Hashmi
CRL/CANMET
Devon, Alberta

Subject: **CANMET MARKET SURVEY - PROJECT NO. 8331-15**

Further to our telephone conversation please find the list of equipment included in the test trailers and cost of major items.

1. **Trailers**

(a)	Water treatment	$ 60,000	(1978)
(b)	Devatering unit 1 . . .	70,000	(1983)
(c)	Devatering unit 2 . . .	75,000	(1984)

2. **Major equipment**

(a) Water treatment trailer

-thickener	$ 35,000	(1977)
-solid bowl centrifuge .	75,000	(1977)
-tanks and pumps	35,000	(1978)
-monitors	25,000	(1979)
-construction materials (e.g. pipe, fittings)	25,000	(1979)
-labour	50,000	(1978-79)

(b) Devatering unit #1

-P/F press	$ 80,000	(1983)
-disc filter	95,000	(1983)
-monitors	25,000	(1983-84)
-tanks and pumps	45,000	(1983-84)
-construction material .	35,000	(1983-84)
-labour	75,000	(1983-84)

(c) Devatering unit #2

-filter press	$195,000	(1984)
-screen bowl centrifuge.	170,000	(1984)
-monitors	45,000	(1983-84)
-tanks and pumps	55,000	(1983-84)
-construction material .	75,000	(1984-85)
-labour	150,000	(1984-85)

APPENDIX A

FACSIMILE SURVEY

MARKET RESEARCH OF MOBILE WATER TREATMENT AND DEWATERING PLANTS FOR CRL/CANMET

Introduction

The Coal Research Labs/CANMET wishes to define the best application for its three mobile water treatment/dewatering units at the Coal Research Centre, Devon, Alberta. Although primarily developed for use in the coal industry, these trailers can be adapted for use in a multitude of other industries. A description of the trailers and flowsheets is attached as well as a separate questionnaire.

This is purely a market survey and your response implies no commitment on your part to CANMET. Your responses will be treated in the strictest confidence.

Please answer the relevant questions and return the answered survey by facsimile to the attention of **Grant B. Bosworth.** **The facsimile number is 604-669-0847.**

Your attention to this questionnaire is greatly appreciated and if you have questions, please do not hesitate to call.

Description of the Trailers

The mobile plants are a facility designed for on-site testing at any location where coal preparation plants are operated. The main objective is to use state-of-the-art technology to evaluate effluent water treatment and dewatering of tailings or cleaned coal. The facility is comprised of three trailers which can be used separately or in various combinations. The trailers are used to evaluate production circuits for water treatment or dewatering and demonstrate equipment or procedures to improve performance.

The trailers can be used for workshops at which specified technologies are explained theoretically and practically.
Equipment is mounted on heavy duty highway trailers 15.2 m long by 2.6 m wide by 4.1 m high, suitable for road or rail transport. Staffing usually involves both CRL and operating personnel from the plant.

The fee schedule for 1990-1991 for CANMET employees is listed as follows:

CANMET Employee	Hourly Rate($/h)
Senior Professional	119.00
Intermediate Professional	91.00
Junior Professional	61.00
Senior Technologist	76.00
Junior Technologist	56.00
General Technical	49.00

Mobile Water Treatment Plant Trailer (Flowsheets A1 & A2)

This trailer contains a conventional thickener, classifier cyclone, screenbowl centrifuge, flocculant preparation system and a choice of several methods of mixing slurry with flocculant. The mobile plant is capable of treating up to 40 m3/hr of effluent water. Field trials at coal preparation plants have resulted in a reduction of effluent pumped to tailings ponds and improved flocculant use.

Mobile Dewatering Plant Trailers

This facility consists of two trailers matched in capacity (2-3 tph) that provides alternate technologies to dewater tailings or other process streams products. The trailers can be used in conjunction with the Mobile Water Treatment Plant Trailer.

Mobile Dewatering Unit Number 1 (Flowsheet B1)

The trailer contains a recessed plate pressure filter, disc filter and filter-aid preparation and mixing equipment. The pressure filter is equipped with a hydraulic system for opening and closing the plates, and is designed to allow operation up to 1550 kpa working pressure. The disc filter is a 1.2 m diameter 2-disc unit equipped with controllable vacuum at both forming and drying stages and allows collection of filtrate samples at each stage.

Mobile Dewatering Unit Number 2 (Flowsheet C1)

The trailer contains a belt filter press, a screenbowl centrifuge and filter-aid preparation and addition equipment. The belt press is operated with a hydraulic system to adjust and control the belt tension, alignment and tracking. The centrifuge is equipped with a variable speed and back-

drive and has digital readouts. The mixing of the feed and filter aid can be done by two methods. One method is inline mixing and the second is an inline static mixer. Field testing optimizes retention time and flocculant dosages and predicts cake thickness, cake moisture and solids recovery.

CANMET MARKET SURVEY QUESTIONNAIRE

1. What is your current mechanical dewatering practice? What type of equipment does your plant use? What is the feed moisture and product moisture? Do you have thermal dewatering, if so, what is the feed moisture and product moisture?

2. How do you dispose of your fine refuse product? Do you dewater the fine refuse?

3. Are you meeting your moisture targets, if not, please describe the problem?

4. Have you ever investigated using different types of mechanical dewatering equipment? If yes, please describe?

5. Would you require pilot plant testing before purchasing new equipment and if not how would you proceed in selecting your equipment?

6. Would you consider using an on-site testing facility for dewatering and water treatment?

7. If so, has your firm ever used on-site testing programs for water treatment or dewatering? If yes, please describe?

8. Do you see your plant requiring any future testwork on dewatering?

9. If your firm does dewatering testing how is the testwork completed? Is the work completed in-house, outside laboratories or by equipment manufacturers laboratories?

10. What would be a reasonable testing period, one week, two weeks, one month or six months?

11. Can your firm use a mobile testing facility for water treatment or dewatering? If so, in what capacity?

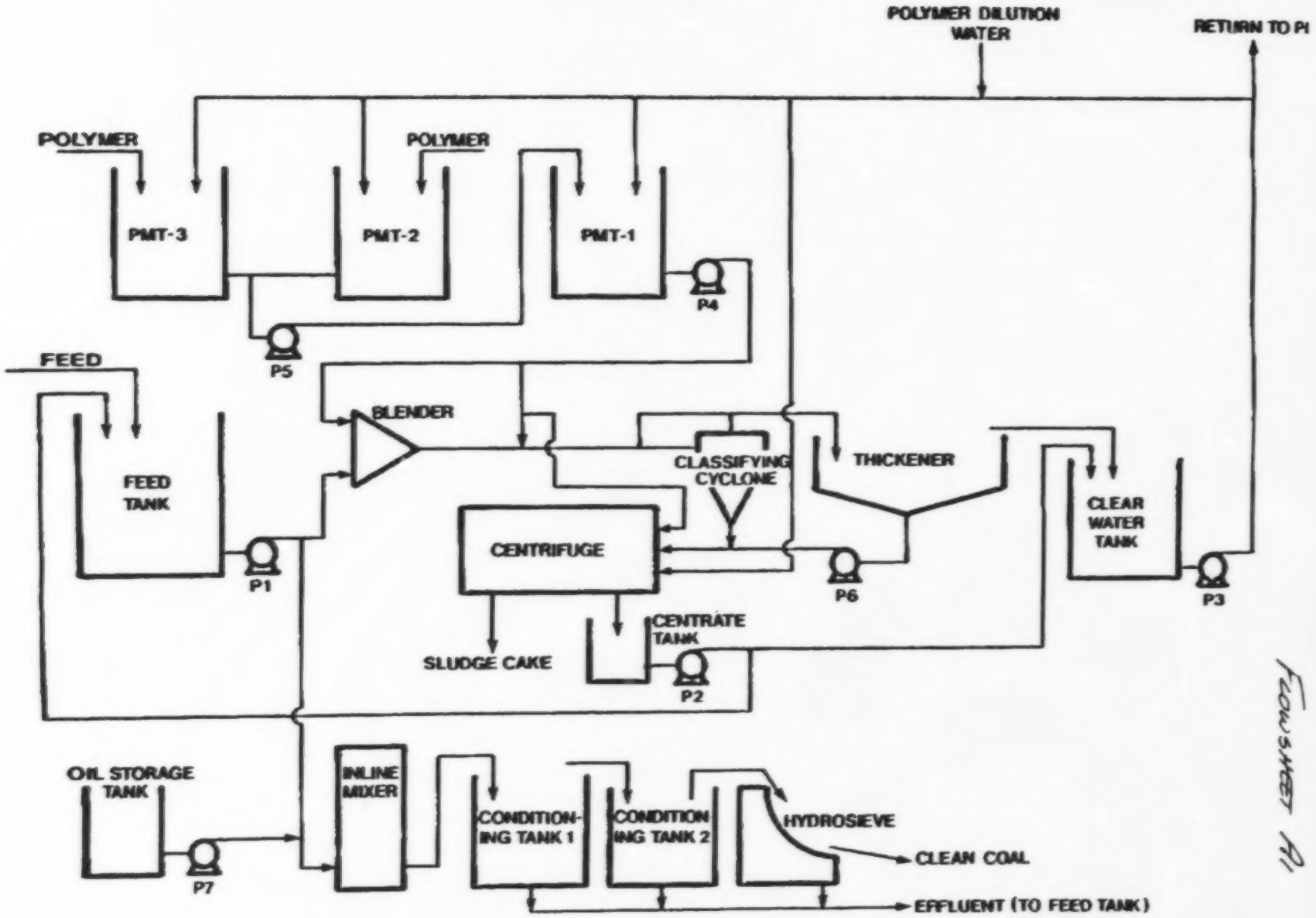
12. Can your firm use these trailers for environmental testwork?

13. Do you see your firm requiring testwork concerning effluent dewatering, primarily for environmental reasons?

14. Would you consider using these trailers for training purposes?

15. Please write any other comments that you feel may be useful in assessing the future needs of the CANMET's water treatment/dewatering trailers?

SENT BY:CAVET CRL DEVON ALBERI 1- 8-91 ; 3:51PM ; EMR-8046890647 ;# 2



MOBILE WATER TREATMENT PLANT - FLOW SHEET

FLOW SHEET A1

FLOWSHEET A2

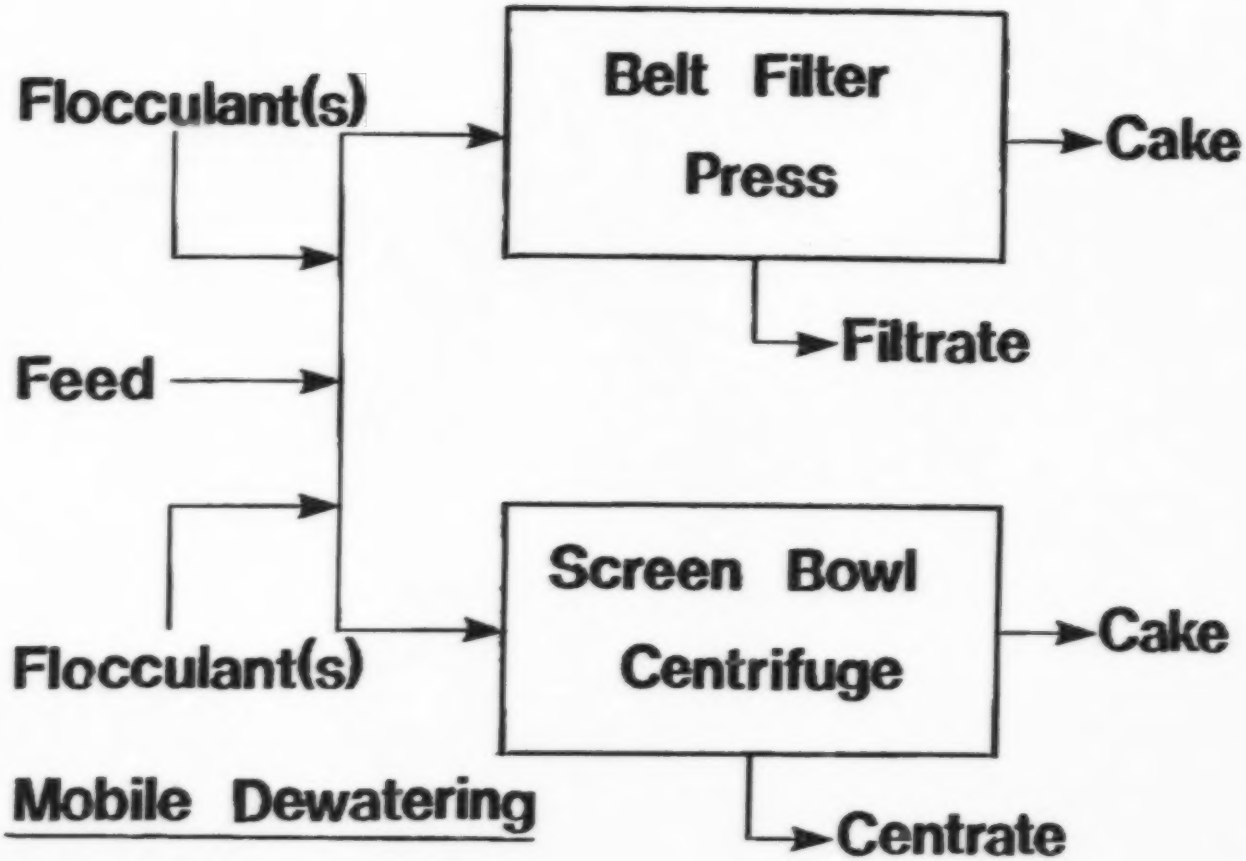
Mobile Water Treatment Plant

FLOWSHEET B.

Mobile Dewatering

Plant No.1

SENT BY:CANMET CRL DEVON ALBER; 1- 6-91 ; 3:54PM ; EMR-6046690847 ;# 8



Mobile Dewatering Plant No. 2

FLOWSHEET C1

APPENDIX B

ANDRITZ
AUTHNER, INC.

TELEFAX 604-669-0847

PS-G

March 7, 1991

Kilborn Engineering
1380 Burrard Street
Suite 400
Vancouver, British Columbia V6Z 2B7

ATTENTION: Mr. Gerard Laman

REFERENCE: ANDRITZ Dewatering Equipment

Dear Mr. Laman:

Pursuant to our earlier telephone conversation, enclosed please find general information and pricing for a trailer mounted mobile screw press dewatering trailer.

A canvas covered trailer and all the auxiliary equipment including pumps, polymer system, controls, air compressor, piping, drain pans, etc. is approximately $200,000.00 (US Funds).

A 24" diameter screw press with a rated capacity of approximately 20-25 BD TPD of a fibrous pulp & paper primary sludge will cost approximately $275,000.00 (US Funds).

This pricing does not include any pre-thickening preceding the screw press which is generally required to maintain and optimize performance. The price for a rotary drum type thickener would be approximately $60,000.00 (US Funds).

Cake solids will vary depending upon the sludge characteristics, but generally average 45-50% T.S.

Screw presses are excellent devices for attaining very high final dryness (50%) on sludge high in fiber (primary) versus biological (secondary). Limitations are in the amount of secondary allowable in the blend once the ratio approaches 60:40 (by weight) we find the screw press in most cases is not applicable.

1010 Commercial Blvd. S., Arlington, TX 76017 (817) 465-5611 FAX (817) 468-3961 TELEX 794053

For difficult to dewater applications, heat can be introduced by the process of feeding steam into the center shaft for conditioning the sludge. The steam will not directly contact the product. It is the combination of pressure and elevated temperature that allows the press to obtain high cake solids; viscosity is lowered, internal pressure is increased within the cell structure.

In summary, pricing for a trailer mounted mobile screw press trailer could easily exceed $500,000.00 (US Funds). I have enclosed product literature, drawings, specifications, and our reference list for your review.

After you have had the chance to review the enclosed information and should you require additional information, please do not hesitate in calling me at 817-465-5611.

Sincerely,

Steve Fowler
Environmental Market Manager

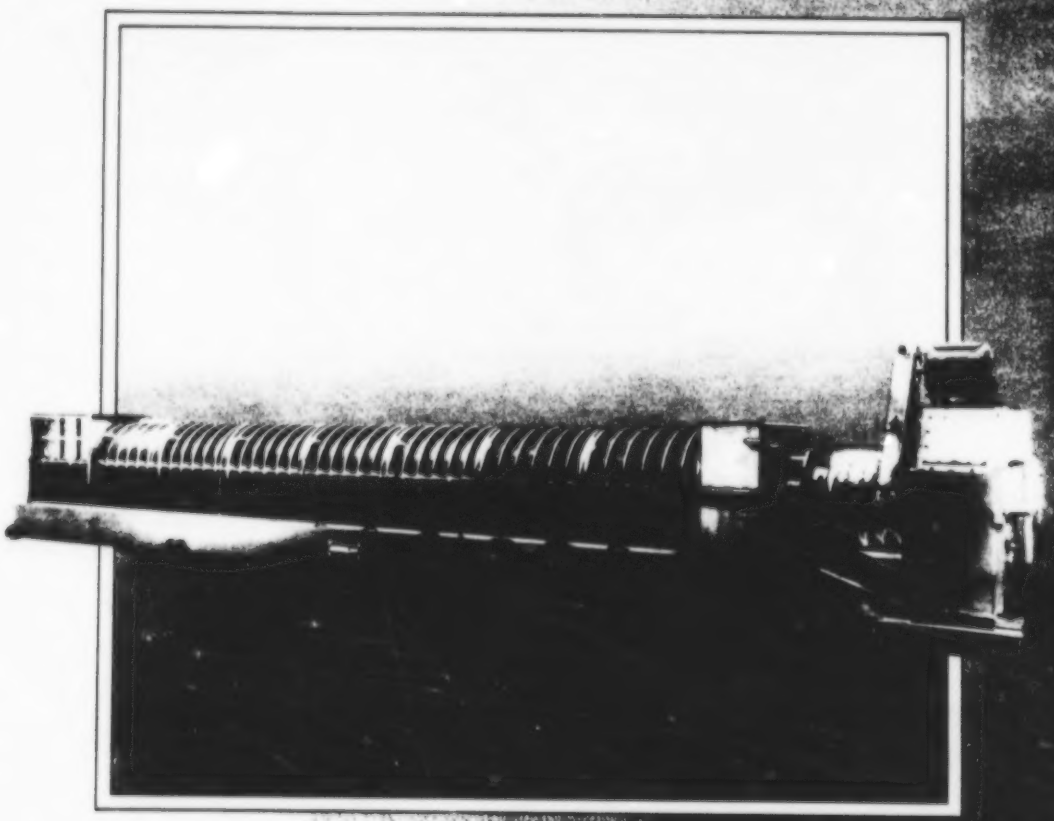
SF/amr

Enclosures

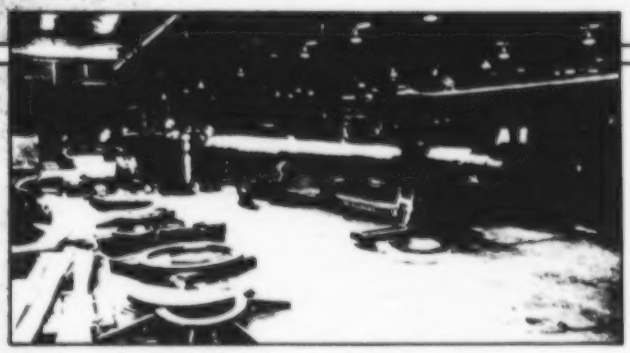
cc: Mr. Franz Resch; ANDRITZ Vancouver

HO
SCRE

FOR PULP
SLUDGE D



ANDRITZ
AUTHNER, INC.



DUPPS MANUFACTURING FACILITY
Germantown, Ohio

ANDRITZ DEWATERING ENGINEERING

ANDRITZ has combined its process knowledge of sludge dewatering with the manufacturing expertise of the Dupps Company at Germantown, Ohio, to provide the first U.S. manufacturer of [illegible] presses, specifically designed for municipal sludges.

With 30 years of experience in sludge and paper dewatering, ANDRITZ has a unique understanding of sludge processing requirements.

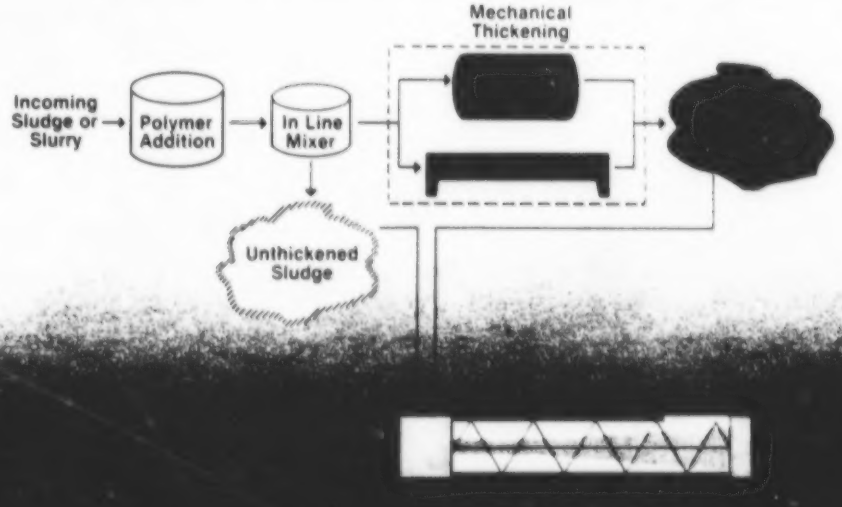
At ANDRITZ, we have a tradition of outstanding service to customers. Our commitment to quality, dependability of operation and support is backed by dedicated people. We have been and are continuing to develop [illegible] solutions to all dewatering needs.

THE COMPLETE SOLUTION

A successful dewatering system requires more than just good machinery – it requires know-how and experience. ANDRITZ will supply all the components completing the system integration, including full automated control – THE COMPLETE SOLUTION.

We encourage you to verify our performance and workmanship by talking with mills who have selected the ANDRITZ solution.

DEWATERING PROCESS FLOW



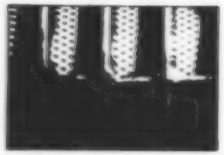
SCREW SHAFT
Stainless steel, tapered screw shaft with replaceable wear plates.

HORIZONTAL SCREW PRESS

U.S. DRIVE COMPONENTS
Direct-coupled quadruple gear reducer with automatic variable speed.

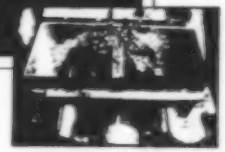
ANDRITZ
ANDRITZ-RUTHNER, INC.

STEAM INJECTION
Additional cake dryness achieved by adding steam into center shaft.



CAST CAGES
Machined stainless steel cast cages eliminate possible welding failures.

COMMON BASE
Sturdiness and ease of Screw Press installation enhanced by common base.



PNEUMATIC CHOKE
Automatically controlled, trouble-free pneumatic choke provides lock-up protection.

MECHANICAL PRETHICK

ANDRITZ manufactures [illegible] Screen Tables for prethickening [illegible] in each Press. The following [illegible] the result experience in mill trials:

REASONS FOR [illegible]

- Volume Reduction
- Increased Throughput
- Higher Solids Content
- More Consistent Cake Solids & Throughput

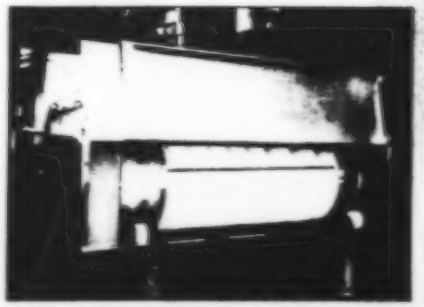
FEATURES

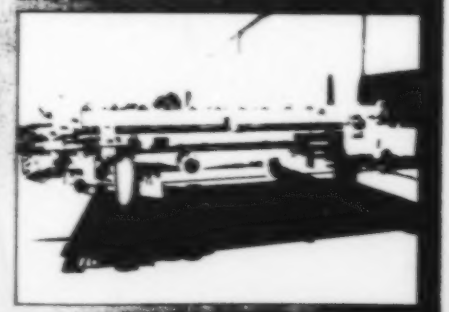
- Unique Feed Chute Design
- Steam Drying Capability
- Cast Cages
- Adjustable Clearance Between Screen and Shaft Flighting
- Common Base for Press and Drive
- Uniquely Designed Tapered Shaft
- Pneumatic Choke with Torque Limiting Device
- Quadruple Gear Reduction
- Replaceable Wear Plates in High Compression Area
- Fully Automated Control System
- Heavy-Duty Bearings to Support Shaft & Thrust Loads

TECHNICAL DATA:

MODEL NUMBER	SCREW DIA/LGTH	OVERALL DIMENSIONS L	W	H	DRY WT
2420	24"x20'	27'8"	6'11"	5'9"	32,900
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

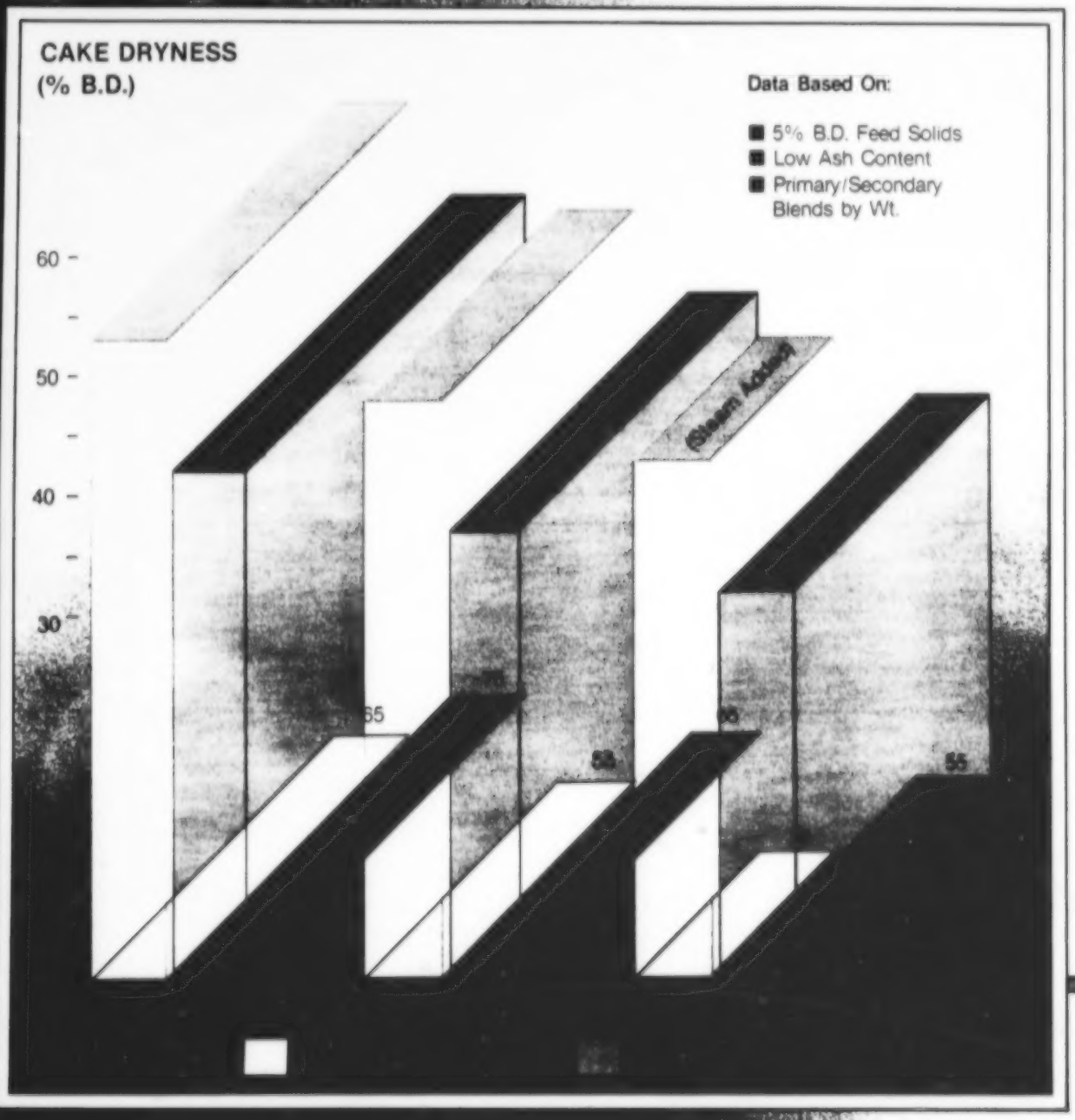
Rotary Screen Thickener





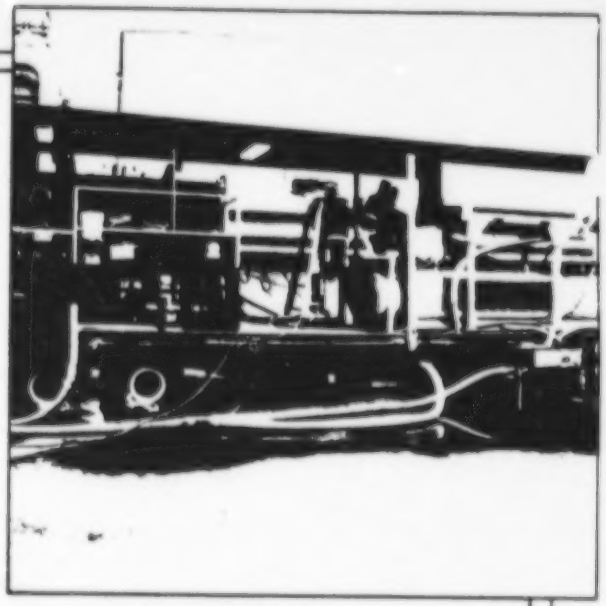
ETHER TO USE A
FILTER PRESS TO
WILL'S SLUDGE.

these field technologies for pulp and
the best alternative? It's a simple



SERVICES PROVIDED BY ANDRITZ INCLUDE:

- Testing (Laboratory and On-Site)
- Installation and Start-Up
- Domestic Parts and Support

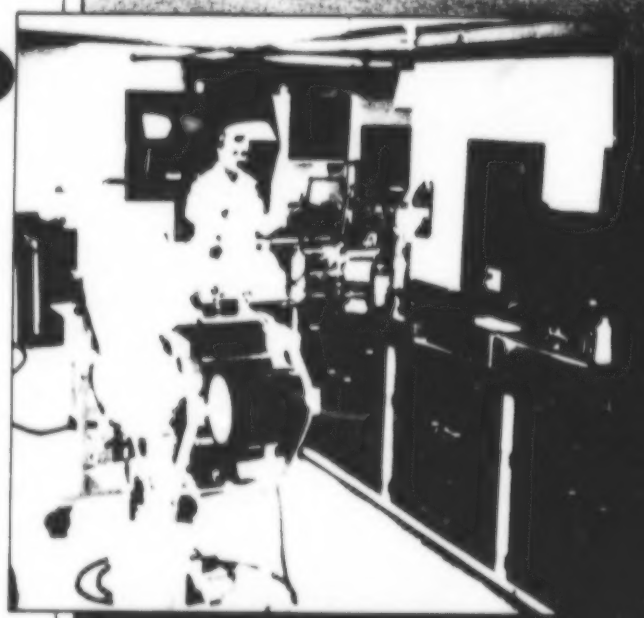


LABORATORY TESTING

Part of the ANDRITZ advantage centers around our ability to perform comprehensive testing of sludge. In our laboratory, we can analyze the sludge and determine what chemical conditioning is required to achieve proper flocculation. We will also establish throughputs, output cake dryness and solids capture rate.

ON-SITE (MOBILE) TESTING

Should on-site testing be required, ANDRITZ [illegible] processing le[illegible]



Dupps Screw Presses are sold exclusively in the N.A. Pulp and Paper Industry by:

ANDRITZ-RUTHNER, INC. ■ 1010 Commercial Blvd. South ■ Arlington, Texas 76017 ■ (817) 465-5611 ■ FAX (817) 468-3961